EMISSION COMPLIANCE REVIEW

NATIONAL LOW EMISSION VEHICLE PROGRAM

The concept of a "Low Emission Vehicle Program" was originally developed and implemented by the California Air Resource Board (CARB or ARB) in the late 1980s. This was necessary to address the unique air quality conditions in California. The LEV Program required that all new vehicles sold in California comply with ARB tailpipe emission standards and that vehicle manufacturers warranty emission control devices for longer periods of time ensuring higher air quality standards.

The California program established the criteria for each level of compliance and provided them with their now well known names; **TLEV** (Transitional Low Emission Vehicle), **LEV** (Low Emission Vehicle) and **ULEV** (Ultra Low Emission Vehicle).

With each level of compliance, the requirements become more stringent. Vehicles must comply with the set of values during cold engine start up as well as maintain expected levels through the life of the vehicle.

The EPA adopted the ARB program as the model for the ***National Low Emission Vehicle Program*** (NLEV).

The NLEV program has been used voluntarily by the northeastern states of the U.S. to address increasing smog problems in this area of the country.

Grams per Mile @ 50° F - Cold Engine Startup			
Compliance Level	NMHC Non Methane Hydrocarbon	CO Carbon Monoxide	NOx Oxide(s) of Nitrogen
TLEV	0.250	3.4	0.4
LEV	0.131	3.4	0.2
ULEV	0.040	1.7	0.2

Grams/Mile at 50,000 miles			
Compliance Level	NMHC Non Methane Hydrocarbon	CO Carbon Monoxide	NOx Oxide(s) of Nitrogen
TLEV	0.125	3.4	0.4
LEV	0.075	3.4	0.2
ULEV	0.040	1.7	0.2

Grams/Mile at 100,000 miles			
Compliance Level	NMHC Non Methane Hydrocarbon	CO Carbon Monoxide	NOx Oxide(s) of Nitrogen
TLEV	0.156	4.2	0.6
LEV	0.090	4.2	0.3
ULEV	0.055	2.1	0.3

The NLEV program became law earlier this year. The law requires that all vehicles sold in the northeastern states of the country comply with the NLEV standards. Compliance level is based on the total number of vehicles sold starting with the 1999 model year. Complete national phase in will be realized by 2004.

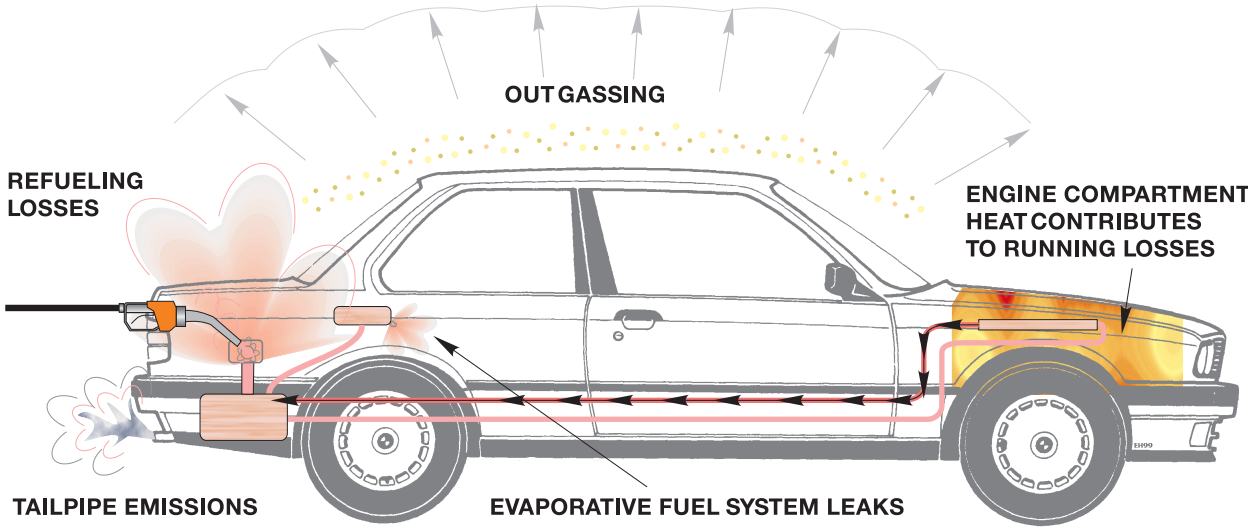
The NLEV program will reduce air pollution nationwide, harmonize Federal and California standards to reduce manufacturers design and testing costs and to avoid a patchwork of statewide regulatory requirements. All of the recent advancements in emission control technologies are due to EPA compliance.

The evolution of the 1999 model year BMW engines described in this manual is partly due to achieving LEV compliance. However, there are changes that have been made to *"technically update"* the engines, helping to maintain the world class performance and reliability of our vehicles.

MANAGING VOLATILE ORGANIC COMPOUNDS

Volatile Organic Compounds (VOCs) are hydrocarbon-based emissions released through evaporation or combustion. Tailpipe emissions are not the only contributor of VOCs. The term “VOC” is usually used in regard to stationary emission sources which escape to atmosphere and contribute to poor air quality.

The most familiar VOC is fuel system hydrocarbons (gasoline vapors). However, other VOCs are produced by motor vehicles. These include evaporating engine oil, windshield washer fluid, paints, solvents and the gradual outgassing of petroleum based vehicle components such as plastics, rubber materials and compounds.



The EPA has addressed outgassing or release of VOCs to atmosphere by categorizing and mandating the following:

- **Use vehicle components and materials manufactured to minimize VOCs.** BMW only uses “environmentally friendly” products, components or materials which minimize VOC generation.
- **Running Losses Compliance:** Reduce the generation of fuel system HC as the vehicle is being driven.
- **Monitor the vehicles evaporative fuel system for leaks (OBD II compliance).**
- **Onboard Refueling Vapor Recovery (ORVR) Compliance:** Reduce the release of fuel system HC to atmosphere while refueling.

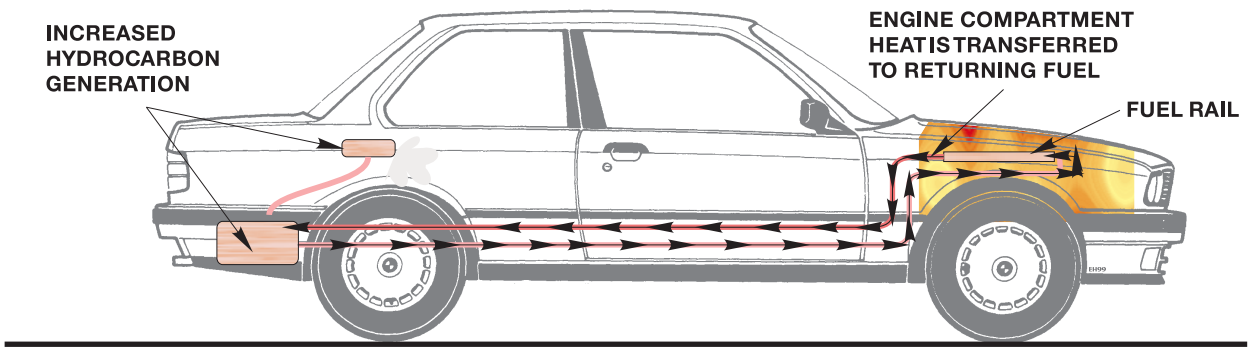
The following pages provide an overview of the systems added to the vehicles to meet the EPA requirements. Attend the Engine Electronics (ST055) and On Board Diagnostics II (ST060) technical training courses for detailed functionality and hands-on diagnostic practical exercises for these systems.

RUNNING LOSSES

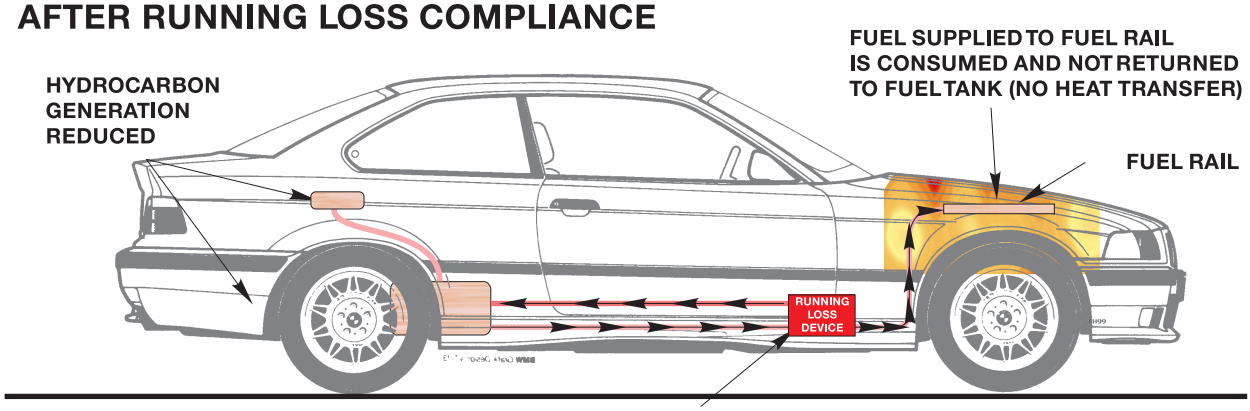
The fuel system is the largest contributor to running losses. For example;

- An electric fuel pump cycles the entire contents of the fuel tank through the fuel rail and back to the tank twice every hour.
- The fuel absorbs the heat of the engine compartment as it continually cycles through the fuel rail and raises to a temperature as high as 158°F.
- The added heat causes the gasoline to vaporize increasing the amount of HC in the fuel system.
- If a leak develops in the system or when the fuel cap is removed at the gas station the additional gasoline vapors generated by the heat of the engine compartment only add to the escaped VOC.

BEFORE RUNNING LOSS COMPLIANCE



AFTER RUNNING LOSS COMPLIANCE



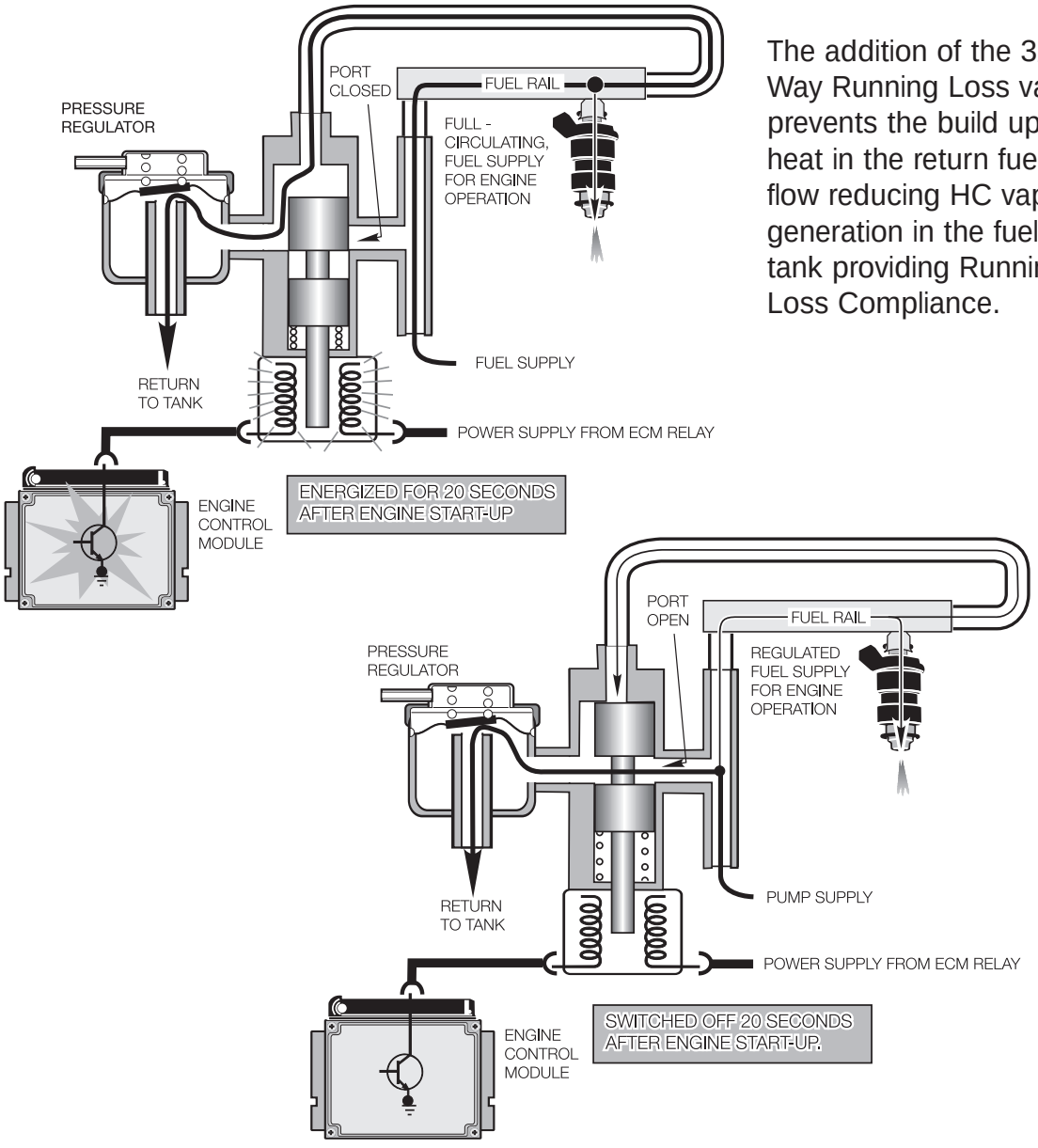
The EPA requires a method of minimizing Running Losses. The system must minimize the temperature build up of the fuel to reduce the generation of hydrocarbons as the vehicle is being driven.

3/2 WAY RUNNING LOSS VALVE

Starting with the 1995 model year, a redesigned fuel pressure regulator with by-pass solenoid known as the 3/2 Way Running Loss Valve was introduced on a small percentage of 325i models. As of the 1998 model year all BMW vehicles are now equipped with the valve.

The valve is located under the vehicle away from the engine compartment heat and incorporates the fuel pressure regulator. During engine start, the valve is activated providing 100% fuel flow to the fuel rail for 20 seconds. After 20 seconds, the valve is switched off providing an open port for fuel return back to the tank.

A regulated fuel supply is continually provided to the fuel injectors for combustion but the supply is not returned to the tank.



The addition of the 3/2 Way Running Loss valve prevents the build up of heat in the return fuel flow reducing HC vapor generation in the fuel tank providing Running Loss Compliance.

EVAPORATIVE SYSTEM MONITORING

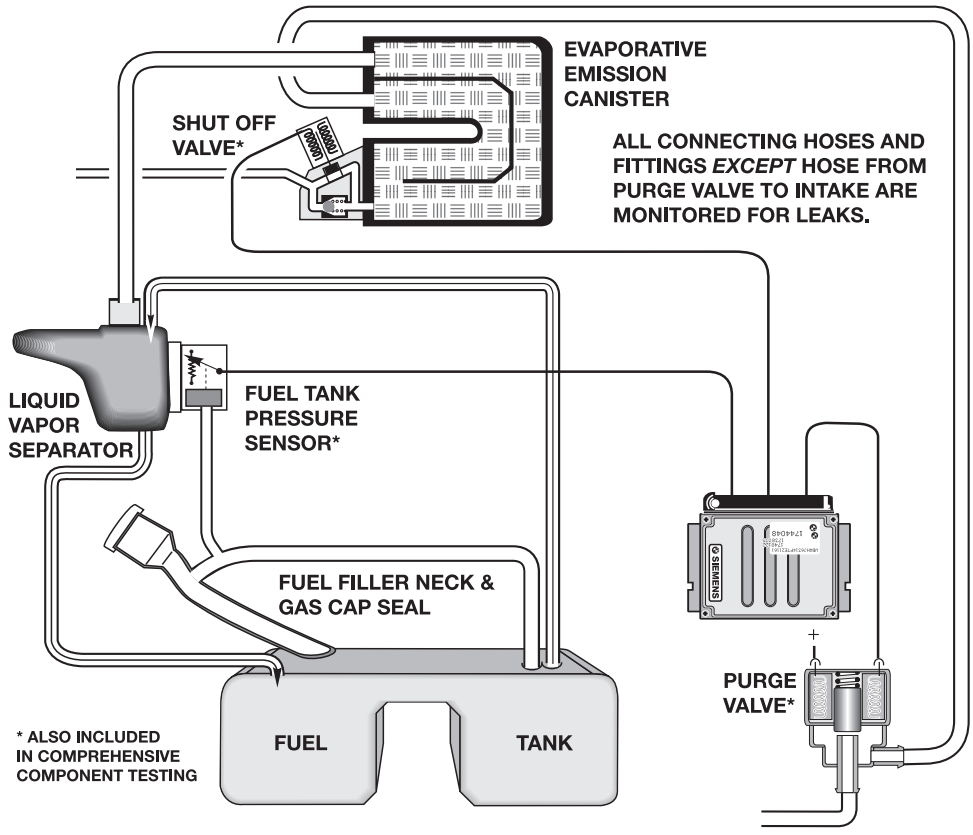
As part of OBD II compliance, the engine control module must monitor the evaporative fuel system for leaks as small as 1.0mm (.040”).

E36 TLEV VACUUM SYSTEM

Starting with the 96 328i and through the 97/99 model years on all E36 vehicles, the fuel tank and evaporative system was modified to comply with evaporative system leak detection and for monitoring purge valve function.

Components: The evaporative system was redesigned from previous systems. Additional components were added to provide leak detection capabilities and to store a larger volume of fuel hydrocarbons. The components include:

- Charcoal Canister with integral Shut Off Valve
- Evaporative Purge Valve
- Fuel Tank Pressure Sensor (transducer)
- Liquid/Vapor Separator
- Vehicle Fuel Tank

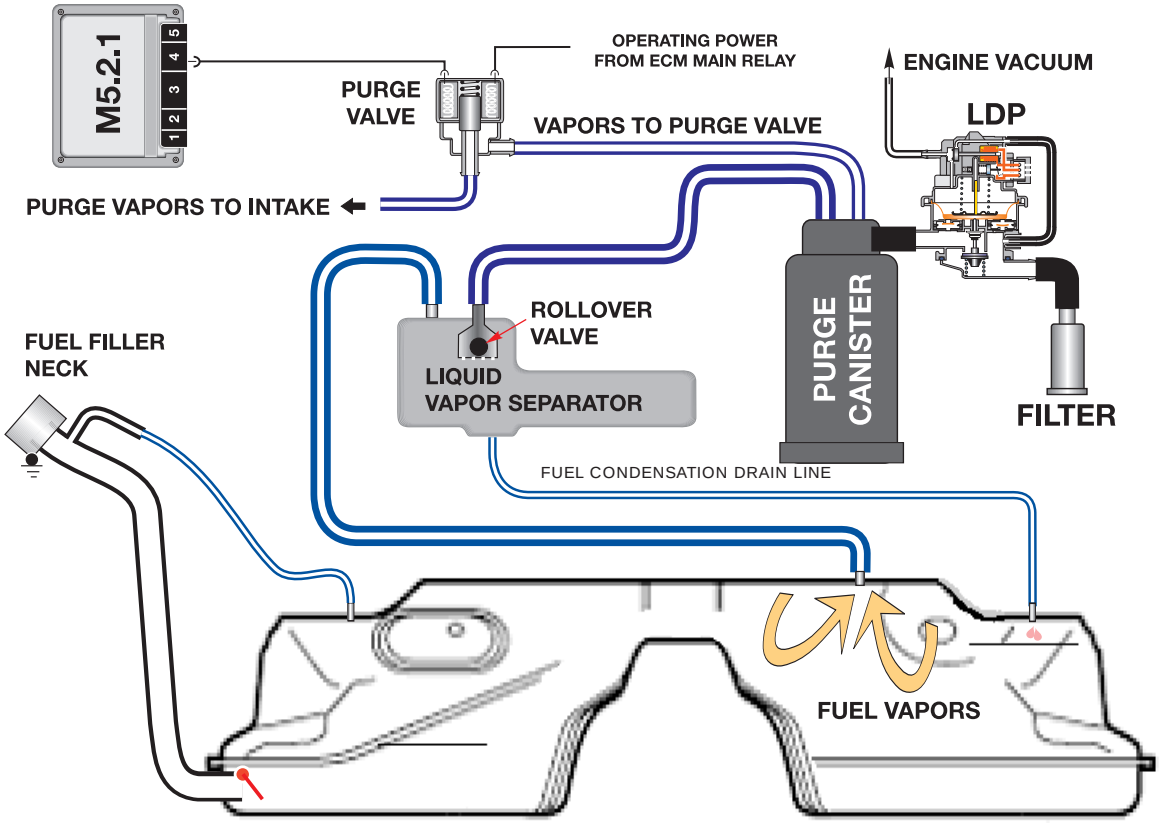


Functional Overview: The ECM detects leaks by closing the shut off valve on the charcoal canister to seal the system. The purge valve is opened subjecting the evaporative system and fuel tank to manifold vacuum. The ECM measures the vacuum value with the fuel tank pressure sensor. The duration of time the system retains the vacuum is the method used to determine the system’s integrity.

LEAK DIAGNOSIS PUMP (LDP SYSTEM)

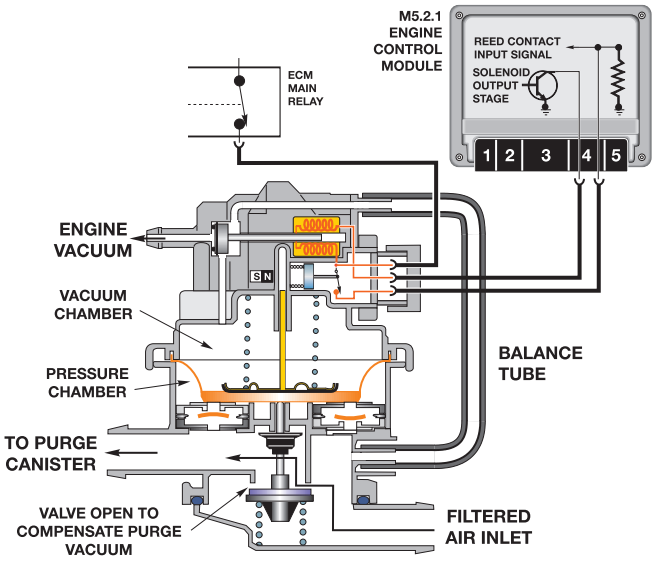
Starting with the 98 model year a new method of evaporative system leak detection was introduced on E38 and E39 vehicles.

Components: The Leak Diagnosis Pump (LDP) was added to the evaporative fuel system as a new component replacing the electric shut off valve on the charcoal canister and fuel system pressure sensor of the E36 TLEV vacuum system.



Functional Overview:

- The function of the LDP is to pressurize the fuel tank and the evaporative emission system to detect leaks. The pump also serves as the fresh air inlet path during normal purge operation when leak diagnosis is not occurring.
- The pump contains a spring loaded diaphragm which is moved up and down by solenoid controlled engine vacuum to generate the air pressure used for leak testing.



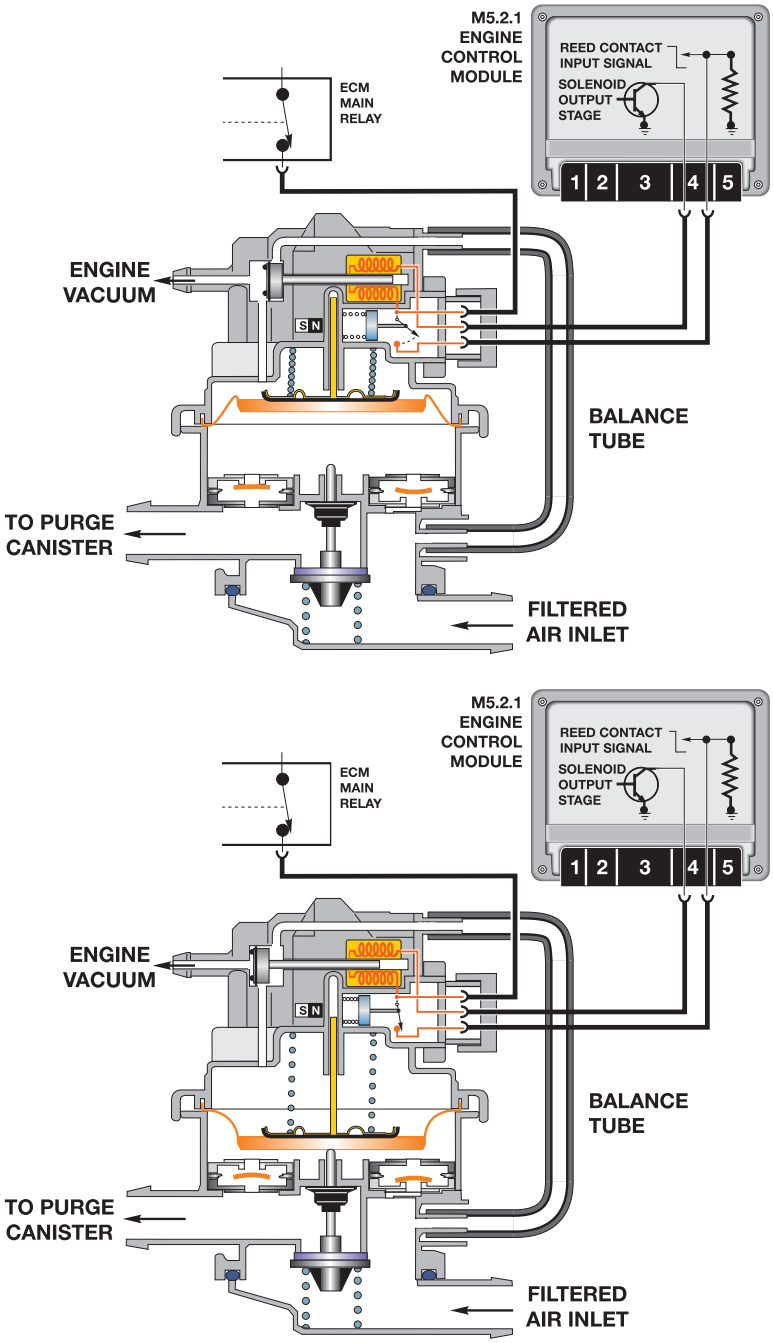
- During a leak test, the normally open vent valve is sprung closed to retain the built up pressure.

- The purge valve(s) are also sprung closed to seal the system.

- The reciprocation of the diaphragm pulls in filtered ambient air and pumps it into the fuel system via the purge canister as the vacuum supply is repetitively opened and closed electrically by the ECM.

- The ECM monitors the diaphragm movement through a reed contact feedback signal and compares it to its activation output frequency of the vacuum solenoid in the LDP.

- As the pump continues to operate the diaphragm begins to slow down against the built up pressure in the system. The time delay between the vacuum solenoid activation and the reed contact feedback is the basis for leak detection.



- If the reed contact feedback signal slows down considerably this indicates the pressure is being held by the system and no leaks are present.

- If the reed contact feedback signal is slowed down but not to the satisfaction of a sealed system the ECM will determine a small leak is present.

- If there is no delay in the feedback signal the ECM determines a large leak is present (ie: missing fuel filler cap).

0.5mm LEAK DETECTION COMPLIANCE

0.5mm leak detection compliance ***was originally scheduled*** for E46 and Z3 vehicles (excluding M) starting with 4-99 production. Compliance phase in has been ***postponed*** until model year 2000. Vehicle control modules were however produced to comply with the smaller 0.5mm diameter leak detection program prior to the postponement decision.

Therefore, E46 and Z3 vehicles with MS 42.0 engine management system (SOP 4-99) will detect evaporative system leaks as small as 0.5 mm and set a specific fault code. However the check engine light will not illuminate if this specific fault is determined.

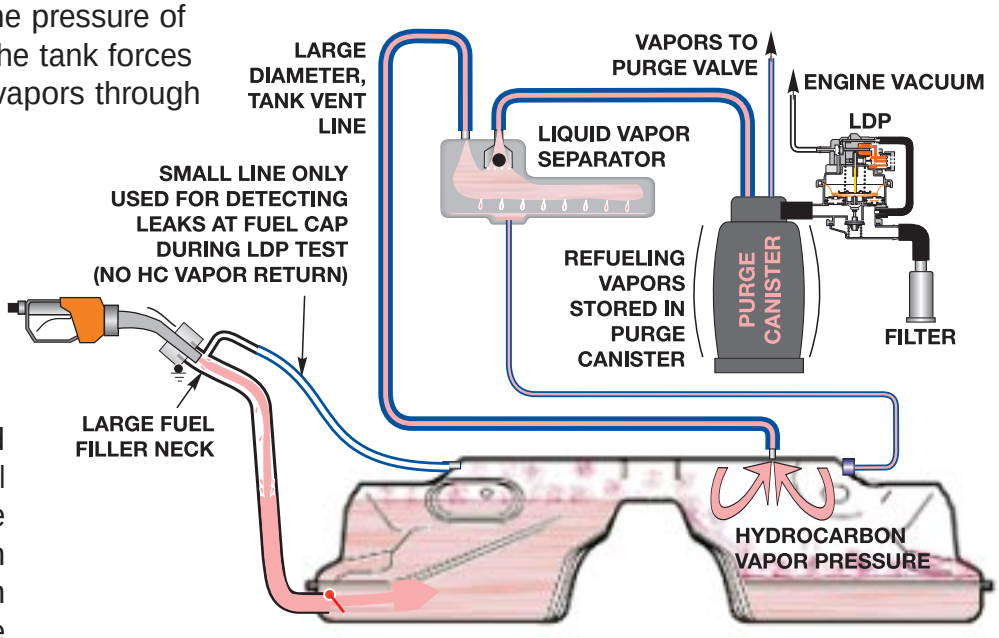
This system will continue to monitor the evaporative system as it currently does and illuminate the check engine light following the existing OBD II criteria for 1.0mm leak detection.

ON-BOARD REFUELING VAPOR RECOVERY (ORVR)

The ORVR system recovers and stores hydrocarbon fuel vapor that was previously released during refueling. Non ORVR vehicles vent fuel vapors from the tank venting line back to the filler neck and in many states reclaimed by a vacuum receiver (Stage II) on the filling station's fuel pump nozzle.

When refueling, the pressure of the fuel entering the tank forces the hydrocarbon vapors through the tank vent line to the liquid/ vapor separator, through the rollover valve and into the charcoal canister.

The HC is stored in the charcoal canister, and the system can then "breathe" through the LDP and the air filter.



ORVR phase in started in the 1998 model year. By model year 2000, all new vehicles sold must be equipped with an ORVR system. The EPA estimates an average of 78 million gallons of gasoline will have been saved from evaporation between the years 1998 and 2020. Additionally, 400,000 tons of smog producing volatile organic compounds (VOC) will be captured annually because of ORVR.

ON BOARD DIAGNOSTICS II

In parallel with the Low Emission Vehicle program, the ARB developed and mandated OBD II. OBD II as we are aware, requires that all vehicle manufacturers comply with extensive fault monitoring capabilities for all emission related drivetrain control systems.

These systems; DME, AGS and EML must monitor their components electrically and monitor for plausible mechanical engine function. Additionally, OBD II provides a separate Diagnostic Link Connector (DLC) located in the vehicle interior to access OBD II fault codes with an aftermarket scan tool.

BMW center technicians have the advantage of utilizing BMW diagnostic equipment and software (DIS/MoDiC) to interface with all vehicle control systems. However, understanding how OBD II compliance has changed engine mechanical hardware and control system monitoring capabilities should be understood by all BMW center technicians.

All U.S. market BMW vehicles have been OBD II compliant since the 1996 model year.

Enroll in the On Board Diagnostics II (ST060) training course for;

- Detailed understanding of OBD II.
- How OBD II effects vehicle systems.
- Detailed system diagnosis of all current emission related components.

The OBD II training course provides a hands on training environment for diagnosis and working with OBD II specific diagnostic exercises pertaining to :

- Drive Cycles/Trips and the Check Engine Light
- OBD II Diagnostic Trouble Codes (DTC)
- Engine Misfire diagnosis
- Understanding oxygen sensor signals specific to Catalytic converter monitoring.
- Oxygen sensor monitoring
- Evaporative emission system monitoring
- Fuel System Monitoring
- Secondary Air Injection System monitoring
- Comprehensive Component Monitoring